



SEQUENCE LISTING

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MURRAY, JAMES A.H.

<120> NOVEL ENZYME

<130> 1498-119

<140> 09/763,824

<141> 2002-04-29

<150> PCT/GB99/03538

<151> 1999-10-26

<150> GB 9823468.5

<151> 1998-10-28

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<400> 1

cgccggtgag ctccccgccg ccg

23

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<400> 2

cggcggcggg gagctcacg gcg

23

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<212> DNA

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<223> Description of Artificial Sequence: Primer

<400> 3

cgaacacttc ttcacgttg accgccttaa gtctttaatt aaatacaaag g 51

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<400> 5

gaaaggcccg gcaccagcct atcctctaga gg 32

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<400> 6

cctctagcgg ataggctggt gccgggcctt tc 32

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<400> 7

ccataaattt accgaattcg tcgacttcga tcgagg 36

<210> 8
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 8
gtgtggaatt gtgagcgg 18

<210> 9
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<400> 9
gagatacgcc gcggttcctg g 21

<210> 10
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<220>
<223> Description of Artificial Sequence: Primer

<400> 10
ccaggaaccg cggcgtatct c 21

<210> 11
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<220>
<223> Description of Artificial Sequence: Primer

<400> 11
ccctattttc attcctggcc aaaagcactc 30

<210> 12
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<223> Description of Artificial Sequence: Primer

<400> 12
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<210> 13
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 <223> Description of Artificial Sequence: Primer

<400> 13
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<210> 14
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 <212> DNA
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<220>
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<400> 14
 gaatctgacg cagagagctc tatgcgg 27

<210> 15
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 <212> DNA
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 <223> Description of Artificial Sequence: Primer

<400> 15
 gttgaccgct tgggacctt aattaaatac 30

<210> 16
 <211> 22
 <212> DNA
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<220>
 <223> Description of Artificial Sequence: Primer

<400> 16
 gtatagattt gaaaaagagc tg 22

<210> 17
 <211> 22
 <212> DNA
 <213> Artificial Sequence

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 <400> 17
 cagctctttt tcaaattctat ac 22

 <210> 18
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 <212> DNA
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 <400> 18
 ggctacatac tggagacata gc 22

 <210> 19
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 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 19

 gctatgtctc cagtatgtag cc 22

 <210> 20
 <211> 21
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 20
 gcagttgcgc ccgtgaacga c 21

 <210> 21
 <211> 21
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 21
 gtcgttcacg ggcgcaactg c 21

 <210> 22

<211> 29
 <212> DNA
 <213> Artificial Sequence
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 <223> Description of Artificial Sequence: Primer
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 caaatcattc cgggtactgc gattttaag 29
 <210> 23
 <211> 29
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 <223> Description of Artificial Sequence: Primer
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 cttaaaatcg cagtaccggg aatgatttg 29
 <210> 24
 <211> 27
 <212> DNA
 <213> Artificial Sequence
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 <210> 25
 <211> 27
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 <213> Artificial Sequence
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 <223> Description of Artificial Sequence: Primer
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 gaatctgacg cagagagttc tatgcgc 27
 <210> 26
 <211> 22
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 <213> Artificial Sequence
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<400> 26
ctgattacac ccaaggggga tg 22

<210> 27
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 27
catccccctt ggggtgtaatc ag 22

<210> 28
<211> 29
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<220>
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<222> (15)..(17)
<223> a, g, c or t

<400> 28
cccttccgca tagannngcc tgcgtcagt 29

<210> 29
<211> 29
<212> DNA

<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<220>
<221> modified_base
<222> (13)..(15)
<223> a, g, c or t

<400> 29
actgacgcag gcnntctat gcggaagg 29

<210> 30
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<212> DNA
<213> Artificial Sequence

<220>
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 <400> 30
 gcaatcaaat cgctccggat actgc 25

 <210> 31
 <211> 25
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 31
 gcagtatccg gagcgatttg attgc 25

 <210> 32
 <211> 20
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 32
 ccattccatc aaggtttttg 20

 <210> 33
 <211> 20
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 33
 ccaaaacctt gatggaatgg 20

 <210> 34
 <211> 25
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Description of Artificial Sequence: Primer

 <400> 34
 aaacagggac ccatatggaa gacgc 25

 <210> 35

<211> 36
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 35
aattaactcg aggaatttcg tcatcgctga atacag 36

<210> 36
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<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 36
ccctatatttc attcctggcc aaaagcactg 30

<210> 37
<211> 550
<212> PRT
<213> *Photinus pyralis*

<400> 37
Met Glu Asp Ala Lys Asn Ile Lys Lys Gly Pro Ala Pro Phe Tyr Pro
1 5 10 15
Leu Glu Asp Gly Thr Ala Gly Glu Gln Leu His Lys Ala Met Lys Arg
20 25 30
Tyr Ala Leu Val Pro Gly Thr Ile Ala Phe Thr Asp Ala His Ile Glu
35 40 45
Val Asn Ile Thr Tyr Ala Glu Tyr Phe Glu Met Ser Val Arg Leu Ala
50 55 60
Glu Ala Met Lys Arg Tyr Gly Leu Asn Thr Asn His Arg Ile Val Val
65 70 75 80
Cys Ser Glu Asn Ser Leu Gln Phe Phe Met Pro Val Leu Gly Ala Leu
85 90 95
Phe Ile Gly Val Ala Val Ala Pro Ala Asn Asp Ile Tyr Asn Glu Arg
100 105 110
Glu Leu Leu Asn Ser Met Asn Ile Ser Gln Pro Thr Val Val Phe Val
115 120 125
Ser Lys Lys Gly Leu Gln Lys Ile Leu Asn Val Gln Lys Lys Leu Pro
130 135 140
Ile Ile Gln Lys Ile Ile Ile Met Asp Ser Lys Thr Asp Tyr Gln Gly

145		150		155		160
Phe Gln Ser Met Tyr Thr Phe Val Thr Ser His Leu Pro Pro Gly Phe	165		170		175	
Asn Glu Tyr Asp Phe Val Pro Glu Ser Phe Asp Arg Asp Lys Thr Ile	180		185		190	
Ala Leu Ile Met Asn Ser Ser Gly Ser Thr Gly Leu Pro Lys Gly Val	195		200		205	
Ala Leu Pro His Arg Thr Ala Cys Val Arg Phe Ser His Ala Arg Asp	210		215		220	
Pro Ile Phe Gly Asn Gln Ile Ile Pro Asp Thr Ala Ile Leu Ser Val	225		230		235	240
Val Pro Phe His His Gly Phe Gly Met Phe Thr Thr Leu Gly Tyr Leu		245		250		255
Ile Cys Gly Phe Arg Val Val Leu Met Tyr Arg Phe Glu Glu Glu Leu		260		265		270
Phe Leu Arg Ser Leu Gln Asp Tyr Lys Ile Gln Ser Ala Leu Leu Val		275		280		285
Pro Thr Leu Phe Ser Phe Phe Ala Lys Ser Thr Leu Ile Asp Lys Tyr		290		295		300
Asp Leu Ser Asn Leu His Glu Ile Ala Ser Gly Gly Ala Pro Leu Ser		305		310		315
Lys Glu Val Gly Glu Ala Val Ala Lys Arg Phe His Leu Pro Gly Ile		325		330		335
Arg Gln Gly Tyr Gly Leu Thr Glu Thr Thr Ser Ala Ile Leu Ile Thr		340		345		350
Pro Glu Gly Asp Asp Lys Pro Gly Ala Val Gly Lys Val Val Pro Phe		355		360		365
Phe Glu Ala Lys Val Val Asp Leu Asp Thr Gly Lys Thr Leu Gly Val		370		375		380
Asn Gln Arg Gly Glu Leu Cys Val Arg Gly Pro Met Ile Met Ser Gly		385		390		395
Tyr Val Asn Asn Pro Glu Ala Thr Asn Ala Leu Ile Asp Lys Asp Gly		405		410		415
Trp Leu His Ser Gly Asp Ile Ala Tyr Trp Asp Glu Asp Glu His Phe		420		425		430
Phe Ile Val Asp Arg Leu Lys Ser Leu Ile Lys Tyr Lys Gly Tyr Gln		435		440		445

Val Ala Pro Ala Glu Leu Glu Ser Ile Leu Leu Gln His Pro Asn Ile
 450 455 460
 Phe Asp Ala Gly Val Ala Gly Leu Pro Asp Asp Asp Ala Gly Glu Leu
 465 470 475 480
 Pro Ala Ala Val Val Val Leu Glu His Gly Lys Thr Met Thr Glu Lys
 485 490 495
 Glu Ile Val Asp Tyr Val Ala Ser Gln Val Thr Thr Ala Lys Lys Leu
 500 505 510
 Arg Gly Gly Val Val Phe Val Asp Glu Val Pro Lys Gly Leu Thr Gly
 515 520 525
 Lys Leu Asp Ala Arg Lys Ile Arg Glu Ile Leu Ile Lys Ala Lys Lys
 530 535 540
 Gly Gly Lys Ser Lys Leu
 545 550

<210> 38

<211> 550

<212> PRT

<213> *Photinus pyralis*

<220>

<221> VARIANT

<222> (214)

<223> xaa=an amino acid other than Thr

<400> 38

Met Glu Asp Ala Lys Asn Ile Lys Lys Gly Pro Ala Pro Phe Tyr Pro
 1 5 10 15
 Leu Glu Asp Gly Thr Ala Gly Glu Gln Leu His Lys Ala Met Lys Arg
 20 25 30
 Tyr Ala Leu Val Pro Gly Thr Ile Ala Phe Thr Asp Ala His Ile Glu
 35 40 45
 Val Asn Ile Thr Tyr Ala Glu Tyr Phe Glu Met Ser Val Arg Leu Ala
 50 55 60
 Glu Ala Met Lys Arg Tyr Gly Leu Asn Thr Asn His Arg Ile Val Val
 65 70 75 80
 Cys Ser Glu Asn Ser Leu Gln Phe Phe Met Pro Val Leu Gly Ala Leu
 85 90 95
 Phe Ile Gly Val Ala Val Ala Pro Ala Asn Asp Ile Tyr Asn Glu Arg
 100 105 110
 Glu Leu Leu Asn Ser Met Asn Ile Ser Gln Pro Thr Val Val Phe Val
 115 120 125

Ser Lys Lys Gly Leu Gln Lys Ile Leu Asn Val Gln Lys Lys Leu Pro
 130 135 140

Ile Ile Gln Lys Ile Ile Ile Met Asp Ser Lys Thr Asp Tyr Gln Gly
 145 150 155 160

Phe Gln Ser Met Tyr Thr Phe Val Thr Ser His Leu Pro Pro Gly Phe
 165 170 175

Asn Glu Tyr Asp Phe Val Pro Glu Ser Phe Asp Arg Asp Lys Thr Ile
 180 185 190

Ala Leu Ile Met Asn Ser Ser Gly Ser Thr Gly Leu Pro Lys Gly Val
 195 200 205

Ala Leu Pro His Arg Xaa Ala Cys Val Arg Phe Ser His Ala Arg Asp
 210 215 220

Pro Ile Phe Gly Asn Gln Ile Ile Pro Asp Thr Ala Ile Leu Ser Val
 225 230 235 240

Val Pro Phe His His Gly Phe Gly Met Phe Thr Thr Leu Gly Tyr Leu
 245 250 255

Ile Cys Gly Phe Arg Val Val Leu Met Tyr Arg Phe Glu Glu Glu Leu
 260 265 270

Phe Leu Arg Ser Leu Gln Asp Tyr Lys Ile Gln Ser Ala Leu Leu Val
 275 280 285

Pro Thr Leu Phe Ser Phe Phe Ala Lys Ser Thr Leu Ile Asp Lys Tyr
 290 295 300

Asp Leu Ser Asn Leu His Glu Ile Ala Ser Gly Gly Ala Pro Leu Ser
 305 310 315 320

Lys Glu Val Gly Glu Ala Val Ala Lys Arg Phe His Leu Pro Gly Ile
 325 330 335

Arg Gln Gly Tyr Gly Leu Thr Glu Thr Thr Ser Ala Ile Leu Ile Thr
 340 345 350

Pro Glu Gly Asp Asp Lys Pro Gly Ala Val Gly Lys Val Val Pro Phe
 355 360 365

Phe Glu Ala Lys Val Val Asp Leu Asp Thr Gly Lys Thr Leu Gly Val
 370 375 380

Asn Gln Arg Gly Glu Leu Cys Val Arg Gly Pro Met Ile Met Ser Gly
 385 390 395 400

Tyr Val Asn Asn Pro Glu Ala Thr Asn Ala Leu Ile Asp Lys Asp Gly
 405 410 415

Trp Leu His Ser Gly Asp Ile Ala Tyr Trp Asp Glu Asp Glu His Phe
 420 425 430

Phe Ile Val Asp Arg Leu Lys Ser Leu Ile Lys Tyr Lys Gly Tyr Gln
435 440 445

Val Ala Pro Ala Glu Leu Glu Ser Ile Leu Leu Gln His Pro Asn Ile
450 455 460

Phe Asp Ala Gly Val Ala Gly Leu Pro Asp Asp Asp Ala Gly Glu Leu
465 470 475 480

Pro Ala Ala Val Val Val Leu Glu His Gly Lys Thr Met Thr Glu Lys
485 490 495

Glu Ile Val Asp Tyr Val Ala Ser Gln Val Thr Thr Ala Lys Lys Leu
500 505 510

Arg Gly Gly Val Val Phe Val Asp Glu Val Pro Lys Gly Leu Thr Gly
515 520 525

Lys Leu Asp Ala Arg Lys Ile Arg Glu Ile Leu Ile Lys Ala Lys Lys
530 535 540

Gly Gly Lys Ser Lys Leu
545 550

<210> 39

<211> 550

<212> PRT

<213> *Photinus pyralis*

<220>

<221> VARIANT

<222> (214)

<223> Xaa=Cys, Ala or Asp

<400> 39

Met Glu Asp Ala Lys Asn Ile Lys Lys Gly Pro Ala Pro Phe Tyr Pro
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Leu Glu Asp Gly Thr Ala Gly Glu Gln Leu His Lys Ala Met Lys Arg
20 25 30

Tyr Ala Leu Val Pro Gly Thr Ile Ala Phe Thr Asp Ala His Ile Glu
35 40 45

Val Asn Ile Thr Tyr Ala Glu Tyr Phe Glu Met Ser Val Arg Leu Ala
50 55 60

Glu Ala Met Lys Arg Tyr Gly Leu Asn Thr Asn His Arg Ile Val Val
65 70 75 80

Cys Ser Glu Asn Ser Leu Gln Phe Phe Met Pro Val Leu Gly Ala Leu
85 90 95

Phe Ile Gly Val Ala Val Ala Pro Ala Asn Asp Ile Tyr Asn Glu Arg
100 105 110

Glu	Leu	Leu	Asn	Ser	Met	Asn	Ile	Ser	Gln	Pro	Thr	Val	Val	Phe	Val		
		115					120					125					
Ser	Lys	Lys	Gly	Leu	Gln	Lys	Ile	Leu	Asn	Val	Gln	Lys	Lys	Leu	Pro		
	130					135					140						
Ile	Ile	Gln	Lys	Ile	Ile	Ile	Met	Asp	Ser	Lys	Thr	Asp	Tyr	Gln	Gly		
145					150					155					160		
Phe	Gln	Ser	Met	Tyr	Thr	Phe	Val	Thr	Ser	His	Leu	Pro	Pro	Gly	Phe		
			165						170					175			
Asn	Glu	Tyr	Asp	Phe	Val	Pro	Glu	Ser	Phe	Asp	Arg	Asp	Lys	Thr	Ile		
			180					185					190				
Ala	Leu	Ile	Met	Asn	Ser	Ser	Gly	Ser	Thr	Gly	Leu	Pro	Lys	Gly	Val		
		195					200					205					
Ala	Leu	Pro	His	Arg	Xaa	Ala	Cys	Val	Arg	Phe	Ser	His	Ala	Arg	Asp		
	210					215					220						
Pro	Ile	Phe	Gly	Asn	Gln	Ile	Ile	Pro	Asp	Thr	Ala	Ile	Leu	Ser	Val		
225					230					235					240		
Val	Pro	Phe	His	His	Gly	Phe	Gly	Met	Phe	Thr	Thr	Leu	Gly	Tyr	Leu		
				245					250					255			
Ile	Cys	Gly	Phe	Arg	Val	Val	Leu	Met	Tyr	Arg	Phe	Glu	Glu	Glu	Leu		
			260					265					270				
Phe	Leu	Arg	Ser	Leu	Gln	Asp	Tyr	Lys	Ile	Gln	Ser	Ala	Leu	Leu	Val		
		275					280					285					
Pro	Thr	Leu	Phe	Ser	Phe	Phe	Ala	Lys	Ser	Thr	Leu	Ile	Asp	Lys	Tyr		
	290					295					300						
Asp	Leu	Ser	Asn	Leu	His	Glu	Ile	Ala	Ser	Gly	Gly	Ala	Pro	Leu	Ser		
305					310					315					320		
Lys	Glu	Val	Gly	Glu	Ala	Val	Ala	Lys	Arg	Phe	His	Leu	Pro	Gly	Ile		
				325					330					335			
Arg	Gln	Gly	Tyr	Gly	Leu	Thr	Glu	Thr	Thr	Ser	Ala	Ile	Leu	Ile	Thr		
			340					345					350				
Pro	Glu	Gly	Asp	Asp	Lys	Pro	Gly	Ala	Val	Gly	Lys	Val	Val	Pro	Phe		
		355					360					365					
Phe	Glu	Ala	Lys	Val	Val	Asp	Leu	Asp	Thr	Gly	Lys	Thr	Leu	Gly	Val		
	370					375					380						
Asn	Gln	Arg	Gly	Glu	Leu	Cys	Val	Arg	Gly	Pro	Met	Ile	Met	Ser	Gly		
385					390					395					400		
Tyr	Val	Asn	Asn	Pro	Glu	Ala	Thr	Asn	Ala	Leu	Ile	Asp	Lys	Asp	Gly		

405	410	415
Trp Leu His Ser Gly Asp Ile Ala Tyr Trp Asp Glu Asp Glu His Phe		
420	425	430
Phe Ile Val Asp Arg Leu Lys Ser Leu Ile Lys Tyr Lys Gly Tyr Gln		
435	440	445
Val Ala Pro Ala Glu Leu Glu Ser Ile Leu Leu Gln His Pro Asn Ile		
450	455	460
Phe Asp Ala Gly Val Ala Gly Leu Pro Asp Asp Asp Ala Gly Glu Leu		
465	470	475
Pro Ala Ala Val Val Val Leu Glu His Gly Lys Thr Met Thr Glu Lys		
485	490	495
Glu Ile Val Asp Tyr Val Ala Ser Gln Val Thr Thr Ala Lys Lys Leu		
500	505	510
Arg Gly Gly Val Val Phe Val Asp Glu Val Pro Lys Gly Leu Thr Gly		
515	520	525
Lys Leu Asp Ala Arg Lys Ile Arg Glu Ile Leu Ile Lys Ala Lys Lys		
530	535	540
Gly Gly Lys Ser Lys Leu		
545	550	

<210> 40
 <211> 550
 <212> PRT
 <213> Photinus pyralis

<220>
 <221> VARIANT
 <222> (214)
 <223> Xaa=Ala

<220>
 <221> VARIANT
 <222> (354)
 <223> Xaa=Lys

<400> 40
 Met Glu Asp Ala Lys Asn Ile Lys Lys Gly Pro Ala Pro Phe Tyr Pro
 1 5 10 15
 Leu Glu Asp Gly Thr Ala Gly Glu Gln Leu His Lys Ala Met Lys Arg
 20 25 30
 Tyr Ala Leu Val Pro Gly Thr Ile Ala Phe Thr Asp Ala His Ile Glu
 35 40 45
 Val Asn Ile Thr Tyr Ala Glu Tyr Phe Glu Met Ser Val Arg Leu Ala

50					55					60					
Glu	Ala	Met	Lys	Arg	Tyr	Gly	Leu	Asn	Thr	Asn	His	Arg	Ile	Val	Val
65					70					75					80
Cys	Ser	Glu	Asn	Ser	Leu	Gln	Phe	Phe	Met	Pro	Val	Leu	Gly	Ala	Leu
				85					90					95	
Phe	Ile	Gly	Val	Ala	Val	Ala	Pro	Ala	Asn	Asp	Ile	Tyr	Asn	Glu	Arg
			100					105					110		
Glu	Leu	Leu	Asn	Ser	Met	Asn	Ile	Ser	Gln	Pro	Thr	Val	Val	Phe	Val
			115					120					125		
Ser	Lys	Lys	Gly	Leu	Gln	Lys	Ile	Leu	Asn	Val	Gln	Lys	Lys	Leu	Pro
	130					135					140				
Ile	Ile	Gln	Lys	Ile	Ile	Ile	Met	Asp	Ser	Lys	Thr	Asp	Tyr	Gln	Gly
145					150					155					160
Phe	Gln	Ser	Met	Tyr	Thr	Phe	Val	Thr	Ser	His	Leu	Pro	Pro	Gly	Phe
			165						170					175	
Asn	Glu	Tyr	Asp	Phe	Val	Pro	Glu	Ser	Phe	Asp	Arg	Asp	Lys	Thr	Ile
			180					185					190		
Ala	Leu	Ile	Met	Asn	Ser	Ser	Gly	Ser	Thr	Gly	Leu	Pro	Lys	Gly	Val
			195				200					205			
Ala	Leu	Pro	His	Arg	Xaa	Ala	Cys	Val	Arg	Phe	Ser	His	Ala	Arg	Asp
			210			215					220				
Pro	Ile	Phe	Gly	Asn	Gln	Ile	Ile	Pro	Asp	Thr	Ala	Ile	Leu	Ser	Val
225					230					235					240
Val	Pro	Phe	His	His	Gly	Phe	Gly	Met	Phe	Thr	Thr	Leu	Gly	Tyr	Leu
				245					250					255	
Ile	Cys	Gly	Phe	Arg	Val	Val	Leu	Met	Tyr	Arg	Phe	Glu	Glu	Glu	Leu
			260					265				270			
Phe	Leu	Arg	Ser	Leu	Gln	Asp	Tyr	Lys	Ile	Gln	Ser	Ala	Leu	Leu	Val
			275				280					285			
Pro	Thr	Leu	Phe	Ser	Phe	Phe	Ala	Lys	Ser	Thr	Leu	Ile	Asp	Lys	Tyr
			290			295					300				
Asp	Leu	Ser	Asn	Leu	His	Glu	Ile	Ala	Ser	Gly	Gly	Ala	Pro	Leu	Ser
305					310					315					320
Lys	Glu	Val	Gly	Glu	Ala	Val	Ala	Lys	Arg	Phe	His	Leu	Pro	Gly	Ile
				325					330					335	
Arg	Gln	Gly	Tyr	Gly	Leu	Thr	Glu	Thr	Thr	Ser	Ala	Ile	Leu	Ile	Thr
			340					345					350		
Pro	Xaa	Gly	Asp	Asp	Lys	Pro	Gly	Ala	Val	Gly	Lys	Val	Val	Pro	Phe

355

360

365

Phe Glu Ala Lys Val Val Asp Leu Asp Thr Gly Lys Thr Leu Gly Val
 370 375 380

Asn Gln Arg Gly Glu Leu Cys Val Arg Gly Pro Met Ile Met Ser Gly
 385 390 395 400

Tyr Val Asn Asn Pro Glu Ala Thr Asn Ala Leu Ile Asp Lys Asp Gly
 405 410 415

Trp Leu His Ser Gly Asp Ile Ala Tyr Trp Asp Glu Asp Glu His Phe
 420 425 430

Phe Ile Val Asp Arg Leu Lys Ser Leu Ile Lys Tyr Lys Gly Tyr Gln
 435 440 445

Val Ala Pro Ala Glu Leu Glu Ser Ile Leu Leu Gln His Pro Asn Ile
 450 455 460

Phe Asp Ala Gly Val Ala Gly Leu Pro Asp Asp Asp Ala Gly Glu Leu
 465 470 475 480

Pro Ala Ala Val Val Val Leu Glu His Gly Lys Thr Met Thr Glu Lys
 485 490 495

Glu Ile Val Asp Tyr Val Ala Ser Gln Val Thr Thr Ala Lys Lys Leu
 500 505 510

Arg Gly Gly Val Val Phe Val Asp Glu Val Pro Lys Gly Leu Thr Gly
 515 520 525

Lys Leu Asp Ala Arg Lys Ile Arg Glu Ile Leu Ile Lys Ala Lys Lys
 530 535 540

Gly Gly Lys Ser Lys Leu
 545 550

<210> 41

<211> 550

<212> PRT

<213> *Photinus pyralis*

<220>

<221> VARIANT

<222> (214)

<223> Xaa=Ala

<220>

<221> VARIANT

<222> (232)

<223> Xaa=Ala

<220>
<221> VARIANT
<222> (354)
<223> Xaa=Lys

<400> 41

Met	Glu	Asp	Ala	Lys	Asn	Ile	Lys	Lys	Gly	Pro	Ala	Pro	Phe	Tyr	Pro
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Leu	Glu	Asp	Gly	Thr	Ala	Gly	Glu	Gln	Leu	His	Lys	Ala	Met	Lys	Arg
			20					25						30	
Tyr	Ala	Leu	Val	Pro	Gly	Thr	Ile	Ala	Phe	Thr	Asp	Ala	His	Ile	Glu
		35					40					45			
Val	Asn	Ile	Thr	Tyr	Ala	Glu	Tyr	Phe	Glu	Met	Ser	Val	Arg	Leu	Ala
	50					55					60				
Glu	Ala	Met	Lys	Arg	Tyr	Gly	Leu	Asn	Thr	Asn	His	Arg	Ile	Val	Val
65					70					75					80
Cys	Ser	Glu	Asn	Ser	Leu	Gln	Phe	Phe	Met	Pro	Val	Leu	Gly	Ala	Leu
				85					90					95	
Phe	Ile	Gly	Val	Ala	Val	Ala	Pro	Ala	Asn	Asp	Ile	Tyr	Asn	Glu	Arg
			100					105					110		
Glu	Leu	Leu	Asn	Ser	Met	Asn	Ile	Ser	Gln	Pro	Thr	Val	Val	Phe	Val
		115					120					125			
Ser	Lys	Lys	Gly	Leu	Gln	Lys	Ile	Leu	Asn	Val	Gln	Lys	Lys	Leu	Pro
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Ile	Ile	Gln	Lys	Ile	Ile	Ile	Met	Asp	Ser	Lys	Thr	Asp	Tyr	Gln	Gly
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Phe	Gln	Ser	Met	Tyr	Thr	Phe	Val	Thr	Ser	His	Leu	Pro	Pro	Gly	Phe
				165					170					175	
Asn	Glu	Tyr	Asp	Phe	Val	Pro	Glu	Ser	Phe	Asp	Arg	Asp	Lys	Thr	Ile
			180					185					190		
Ala	Leu	Ile	Met	Asn	Ser	Ser	Gly	Ser	Thr	Gly	Leu	Pro	Lys	Gly	Val
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Ala	Leu	Pro	His	Arg	Xaa	Ala	Cys	Val	Arg	Phe	Ser	His	Ala	Arg	Asp
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Pro	Ile	Phe	Gly	Asn	Gln	Ile	Xaa	Pro	Asp	Thr	Ala	Ile	Leu	Ser	Val
225					230					235					240
Val	Pro	Phe	His	His	Gly	Phe	Gly	Met	Phe	Thr	Thr	Leu	Gly	Tyr	Leu
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Ile	Cys	Gly	Phe	Arg	Val	Val	Leu	Met	Tyr	Arg	Phe	Glu	Glu	Glu	Leu

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Phe	Leu	Arg	Ser	Leu	Gln	Asp	Tyr	Lys	Ile	Gln	Ser	Ala	Leu	Leu	Val	
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Pro	Thr	Leu	Phe	Ser	Phe	Phe	Ala	Lys	Ser	Thr	Leu	Ile	Asp	Lys	Tyr	
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Asp	Leu	Ser	Asn	Leu	His	Glu	Ile	Ala	Ser	Gly	Gly	Ala	Pro	Leu	Ser	
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Lys	Glu	Val	Gly	Glu	Ala	Val	Ala	Lys	Arg	Phe	His	Leu	Pro	Gly	Ile	
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Arg	Gln	Gly	Tyr	Gly	Leu	Thr	Glu	Thr	Thr	Ser	Ala	Ile	Leu	Ile	Thr	
			340					345					350			
Pro	Xaa	Gly	Asp	Asp	Lys	Pro	Gly	Ala	Val	Gly	Lys	Val	Val	Pro	Phe	
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Phe	Glu	Ala	Lys	Val	Val	Asp	Leu	Asp	Thr	Gly	Lys	Thr	Leu	Gly	Val	
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Asn	Gln	Arg	Gly	Glu	Leu	Cys	Val	Arg	Gly	Pro	Met	Ile	Met	Ser	Gly	
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Tyr	Val	Asn	Asn	Pro	Glu	Ala	Thr	Asn	Ala	Leu	Ile	Asp	Lys	Asp	Gly	
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Trp	Leu	His	Ser	Gly	Asp	Ile	Ala	Tyr	Trp	Asp	Glu	Asp	Glu	His	Phe	
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Phe	Ile	Val	Asp	Arg	Leu	Lys	Ser	Leu	Ile	Lys	Tyr	Lys	Gly	Tyr	Gln	
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Val	Ala	Pro	Ala	Glu	Leu	Glu	Ser	Ile	Leu	Leu	Gln	His	Pro	Asn	Ile	
		450				455					460					
Phe	Asp	Ala	Gly	Val	Ala	Gly	Leu	Pro	Asp	Asp	Asp	Ala	Gly	Glu	Leu	
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Pro	Ala	Ala	Val	Val	Val	Leu	Glu	His	Gly	Lys	Thr	Met	Thr	Glu	Lys	
				485					490					495		
Glu	Ile	Val	Asp	Tyr	Val	Ala	Ser	Gln	Val	Thr	Thr	Ala	Lys	Lys	Leu	
			500					505					510			
Arg	Gly	Gly	Val	Val	Phe	Val	Asp	Glu	Val	Pro	Lys	Gly	Leu	Thr	Gly	
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Lys	Leu	Asp	Ala	Arg	Lys	Ile	Arg	Glu	Ile	Leu	Ile	Lys	Ala	Lys	Lys	
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Tyr Ala Leu Val Pro Gly Thr Ile Ala Phe Thr Asp Ala His Ile Glu
35 40 45
Val Asn Ile Thr Tyr Ala Glu Tyr Phe Glu Met Ser Val Arg Leu Ala
50 55 60
Glu Ala Met Lys Arg Tyr Gly Leu Asn Thr Asn His Arg Ile Val Val
65 70 75 80
Cys Ser Glu Asn Ser Leu Gln Phe Phe Met Pro Val Leu Gly Ala Leu
85 90 95
Phe Ile Gly Val Ala Val Ala Pro Ala Asn Asp Ile Tyr Asn Glu Arg
100 105 110
Glu Leu Leu Asn Ser Met Asn Ile Ser Gln Pro Thr Val Val Phe Val
115 120 125
Ser Lys Lys Gly Leu Gln Lys Ile Leu Asn Val Gln Lys Lys Leu Pro

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Ile Ile Gln Lys Ile Ile Ile Met Asp Ser Lys Thr Asp Tyr Gln Gly				
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Phe Gln Ser Met Tyr Thr Phe Val Thr Ser His Leu Pro Pro Gly Phe				
	165		170	175
Asn Glu Tyr Asp Phe Val Pro Glu Ser Phe Asp Arg Asp Lys Thr Ile				
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Ala Leu Ile Met Asn Ser Ser Gly Ser Thr Gly Leu Pro Lys Gly Val				
	195		200	205
Ala Leu Pro His Arg Xaa Xaa Cys Val Arg Phe Ser His Ala Arg Asp				
	210		215	220
Pro Ile Phe Gly Asn Gln Ile Xaa Pro Asp Thr Ala Ile Leu Ser Val				
	225		230	235 240
Val Pro Phe His His Gly Phe Gly Met Phe Thr Thr Leu Gly Tyr Leu				
	245		250	255
Ile Cys Gly Phe Arg Val Val Leu Met Tyr Arg Phe Glu Glu Glu Leu				
	260		265	270
Phe Leu Arg Ser Leu Gln Asp Tyr Lys Ile Gln Ser Ala Leu Leu Val				
	275		280	285
Pro Thr Leu Phe Ser Phe Phe Ala Lys Ser Thr Leu Ile Asp Lys Tyr				
	290		295	300
Asp Leu Ser Asn Leu His Glu Ile Ala Ser Gly Gly Ala Pro Leu Ser				
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Lys Glu Val Gly Glu Ala Val Ala Lys Arg Phe His Leu Pro Gly Ile				
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Arg Gln Gly Tyr Gly Leu Thr Glu Thr Thr Ser Ala Ile Leu Ile Thr				
	340		345	350
Pro Xaa Gly Asp Asp Lys Pro Gly Ala Val Gly Lys Val Val Pro Phe				
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Phe Glu Ala Lys Val Val Asp Leu Asp Thr Gly Lys Thr Leu Gly Val				
	370		375	380
Asn Gln Arg Gly Glu Leu Cys Val Arg Gly Pro Met Ile Met Ser Gly				
	385		390	395 400
Tyr Val Asn Asn Pro Glu Ala Thr Asn Ala Leu Ile Asp Lys Asp Gly				
	405		410	415
Trp Leu His Ser Gly Asp Ile Ala Tyr Trp Asp Glu Asp Glu His Phe				
	420		425	430

Phe Ile Val Asp Arg Leu Lys Ser Leu Ile Lys Tyr Lys Gly Tyr Gln
435 440 445

Val Ala Pro Ala Glu Leu Glu Ser Ile Leu Leu Gln His Pro Asn Ile
450 455 460

Phe Asp Ala Gly Val Ala Gly Leu Pro Asp Asp Asp Ala Gly Glu Leu
465 470 475 480

Pro Ala Ala Val Val Val Leu Glu His Gly Lys Thr Met Thr Glu Lys
485 490 495

Glu Ile Val Asp Tyr Val Ala Ser Gln Val Thr Thr Ala Lys Lys Leu
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Arg Gly Gly Val Val Phe Val Asp Glu Val Pro Lys Gly Leu Thr Gly
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Lys Leu Asp Ala Arg Lys Ile Arg Glu Ile Leu Ile Lys Ala Lys Lys
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Gly Gly Lys Ser Lys Leu
545 550